# A SURVEY OF THE CLASSIFICATION OF THE AMERICAN SPECIES OF *CERATOPHYLLUS* *s. lat.*

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MORE than twenty years ago we divided the numerous species placed into *Ceratophyllus* Curtis 1832 into groups which rendered it comparatively easy for us to find the right place for a new species. This classification was not published, for several reasons. A breaking up of the genus into its component parts would necessitate the separation of *Ceratophyllus fasciatus* Bosc 1801 and its numerous allies under a new generic name, and one of us was very reluctant to take the responsibility for such a change, because the name *Ceratophyllus fasciatus* had already become so very familiar to the students of Hygiene and Tropical Medicine that a change would be felt as an inconvenience. We further considered it advisable to await the discovery of more species before a detailed classification should be attempted, and, moreover, we hoped that the needs of Systematic and Applied Biology might be satisfied by dividing the large assemblage of species of *Ceratophyllus* into groups and calling each group by the name of one of the familiar contained species, such as *wickhami*-group, *fasciatus*-group, *hirundinis*-group, etc., without giving a generic name to each of the groups of species. This method of dealing with a genus which has become cumbersome has its great advantages, and the writer of this article is quite satisfied with it in the case of the genus *Papilio* with its many hundreds of species. It has the great advantage (1) that one knows at once what kind of species a new one is if the species is stated to belong to a certain group, (2) that the number of generic names is restricted, and (3) that a change in familiar valid names is avoided and therefore the continuity of the names in scientific literature ensured. But—the tendency is all the other way. The splitting-up of *Ceratophyllus* has begun, and there is no means of stopping the process of dissolution from going on. Human nomenclature sits on the neck of divine nature, and, there being an emotional force behind it, has assumed an astounding importance, like the emotional political forces under which humanity suffers. If I here inflict on science a number of new generic names, I plead the excuse that the divisions of *Ceratophyllus* I here define would inevitably be named by somebody else, probably by someone who does not know these fleas, as has happened in other orders of animals.

The genus *Ceratophyllus* as formerly conceived consists of two branches which are not very closely related to each other. It is the merit of Dr. Julius Wagner to have recognised this divergency.

I. Upper eye-bristle at or near margin of antennal groove, above level of eye. On inside of genal area a rod-like sclerite, joined with its anterior end to head-capsule behind median eye-bristle, curved up- and backwards, covered by eye, reappearing behind eye as a thin cord which ends at posterior margin of head behind apex of genal lobe.——This combination of characters is found in many genera of *Siphonaptera*, but the *Ceratophyllinae* which have it are mostly Palaearctic-Asiatic, there being among the known American fleas only one such species which comes within the scope of this paper. This species is *Ceratophyllus*

*terribilis* Roths., which belongs to *Ctenophyllus* Wagn. 1927. A further development of this group is represented by *Odontopsyllus* Baker 1905, in which the hairs on the inner side of the hindcoxa are shortened and partly spiniform.

II. Upper eye-bristle on a level with middle of eye (except if eye is vestigial). No internal sclarified genal cord.——Here belong most species of *Ceratophyllus* in the old sense, among them over eighty American ones. These fleas fall into three groups according to the bristles on the forefemur and on the mid- and hindcoxae. These bristles indicate certain lines of development: the presence of a number of lateral bristles on the outer surface of the forefemur and of longish thin bristles on the inner surface of the mid- and hindcoxae from the base to the apex may be taken as an earlier state from which have arisen in one direction the species in which the bristles both of the forefemur and of the inside of the coxae are reduced in number, and in another direction the species in which the former are preserved and the latter restricted to the apical half of the coxae or almost entirely lost. At first sight, the distinctions of these three groups of species do not seem to be of great importance, but nevertheless they hold good in all the American species, and also the Old World species can be grouped in the same way. But in the Old World the divisions are less well defined: we have here lines of development and therefore must expect intermediate stages to occur. The American species may accordingly be classified as follows:

Group A. Genus 1 to 3: On outer surface of forefemur 1 or no lateral bristle (apart from the ventro-lateral ones).

Group B. Genus 4 to 10: On outer surface of forefemur a number of small lateral bristles; on inner surface of mid- and hindcoxae longish thin bristles from base to apex (apart from the bristles at the anterior margin).

Group C. Genus 11 to 18: On outer surface of forefemur a number of small lateral bristles; on inner surface of mid- and hindcoxae no longish thin bristles in basal half.

1. **Orchopeas** nov. gen.—Genotype: *O. wickhami* Baker 1895.

♂♀. Group A. First pair of plantar bristles of tarsal segment V ventral, in between second pair or almost; hindtarsal segment I shorter than II to IV together. Incrassation of anterior margin of metasternum longer than broad, narrow.

♂. VIII. st. of abdomen narrow, without bristles, but ending with a long membranous flap, which is either ciliated and frayed, or smooth and curved upwards; VIII. t. with few ventral bristles. Vertical arm of IX. st. elbowed on frontal side in or above middle, apical lobe of ventral arm not much longer than broad, strongly convex above, concave beneath, proximal lobe with short, pointed, conspicuous spiniform. Exopodite more or less ham- or club-shaped, being much narrower at base than in apical half or two-thirds, with a row of from 4 to 7 spiniforms, which are short, pointed, of practically equal size and directed upwards, below apex a long marginal bristle.

♀. At and near ventral angle of X. t. proximally to stylet more than 2 bristles. Stylet not noticeably curved. Spermatheca barrel-shaped, widest at apex, its head longer than broad, longer than tail.

Nearctic only.——Here belong, besides the genotype, *O. caedens* Jord. 1925

(= ? *labiatus* Baker), *O. latens* Jord. 1925, *O. labiatus* Baker 1904, *O. leucopus* Baker 1904, *O. nepos* Roths. 1905 and *O. sexdentatus* Baker 1904.

2. **Opisodasys** nov. gen.—Genotype : *O. vesperalis* Jord. 1929.

♂♀. Group A. Genal margin more incurved and frontal tubercle somewhat smaller than in *Orchopeas*. Pronotal comb with more than 20 spines, rarely 19. Incrassation of anterior margin of metasternum shorter than broad. First pair of plantar bristles of tarsal segment V ventral as in *Orchopeas* ; segment I of hindtarsus shorter than II to IV together.

♂. VIII. t. of abdomen either with numerous ventral bristles or with a ventral-apical pointed projection ; VIII. st. narrow, widened at apex or not, with bristles at apex or in middle, without the membranous apical flap of *Orchopeas*. Exopodite with 2 or 3 spiniforms which are directed downwards or distad. Anterior margin of vertical arm of IX. st. straight ; apical lobe of ventral arm much longer than broad, proximal lobe without dark brown spiniform. Anal sternite narrow, long (not conical in lateral aspect), with long bristles.

♀. Anal tergite without lateral bristles except 2 (rarely 3) at angle proximally to stylet ; anal sternite ventrally slightly rounded or nearly straight, not angulate, its bristles straight. Stylet more or less distinctly curved. Head of spermatheca longer than broad, longer than tail, dorsally convex.

Nearctic only.——Here belong, besides the genotype, *O. enoplus* Roths. 1909, *O. keeni* Baker 1896, *O. pseudarctomys* Baker 1904 and *O. robustus* Jord. 1925.

3. **Tarsopsylla** Wagn. 1927.—Genotype : *T. octodecimdentatus* Kolen. 1863.

♂♀. Group A. No frontal tubercle. Midtarsal segment I longer than II, hindtarsal I longer than II to IV together, at least one apical bristle of II extending beyond III ; first pair of plantar bristles of V ventral. Episternum of metathorax narrow.

♂. Hindtarsus and segment I of midtarsus with long thin bristles. 3 antepygidial bristles, upper one minute. VIII. t. with dorsal spiculose area on inside. VIII. st. long, with apical pair of long bristles and a hirsute broad flap. Manubrium of IX. t. as long as manubrium of clasper. Process of clasper long ; exopodite long, its upper third widened. Anal sternite narrow, much longer than tergite, with a row of dorso-marginal bristles.

♀. Bristles of segment II of antenna long. 3 or 4 antepygidial bristles. Stylet with one lateral bristle. Anal tergite depressed in between the bases of the stylets. Head of spermatheca barrel-shaped, one-half or one-third longer than broad.

Palaearctic and Nearctic.——Here belongs *T. coloradensis* Baker 1895.

4. **Thrassis** nov. gen.—Genotype : *Th. acamantis* Roths. 1905.

♂♀. Group B. Bristles of segment II long. Basal abdominal sternite without patch of lateral bristles in upper anterior area (at most 1 bristle present). On outer side of hindfemur no complete sublateral row of bristles, always fewer bristles on outer side than on inside. At least 1 bristle of segment II of hindtarsus extending well beyond IV.

♂. VII. t. more or less deeply excised between the two sets of antepygidial bristles. VIII. st. large, not reduced to a narrow horizontal sclerite, without long filamentous apical appendage. 1 long and 2 minute antepygidial bristles. Anal sternite not extending beyond tergite, the two together conical. IX. t. without projecting manubrium (its frontal margin about at right angles with the manubrium of the clasper). Process of clasper broad, rounded at apex ; exopodite narrow or short, vertical from close to base, more or less distinctly inclining frontad. Wire-like levers of penis long, but at most coiling round once.

♀. 2 or 3 antepygidial bristles. Stylet with 2 or 3 longish lateral bristles. Head of spermatheca globular or higher than long, quite short as compared with tail. Bursa copulatrix (plus its duct) long, without sclerification at bases of the ducts.

Nearctic.——Here also belong : *Th. arizonensis* Baker 1898, *Th. fotus* Jord. 1925, *Th. francisi* Fox 1924, *Th. howelli* Jord. 1925 and *Th. petiolatus* Baker 1904, in all of which the hindtarsal segment I is shorter than II to IV together, as well as *Th. bacchi* Roths. 1905, *Th. gladiolis* Jord. 1925 and *Th. pansus* Jord 1925, in which segment I of hindtarsus equals II to IV.

5. **Diamanus** gen. nov.—Genotype : *D. montanus* Baker 1895.

♂♀. Group B. Close to *Thrassis*, but in ♂ the bristles of antennal segment II short, dorsal groove of occiput deep, VIII. st. quite small, recalling *Myoxopsylla* Wagn. 1927, exopodite very long, narrow, bent frontad, sword-like, and levers of penis coiling round more than once ; in ♀ 2 antepygidial bristles, about equal in length, and the dorsal lateral bristle of stylet much smaller than the ventral one.

Nearctic and Palaearctic.——Here belongs, beside the genotype : *D. mandarinus* J. & R. 1911.

6. **Opisocrostis** nov. gen.—Genotype : *O. hirsutus* Baker 1895.

♂♀. Group B. Frontal tubercle distinct, external, more or less obtuse. Bristles of segment II of antenna long. Basal abdominal sternite with a number of slender bristles in upper anterior half. Hindfemur with a row of sublateral bristles on outside (as well as on inside).

♂. VII. t. not excised between the two sets of antepygidial bristles (1 long, 2 minute). VIII. st. reduced to a slender horizontal sclerite which bears 2 long bristles and an apieal long filamentous appendage. Anal sternite and tergite together conical ; apical area of IX. t. behind sensory plate rather large and spinulose. Process of clasper inclining distad ; exopodite more or less elongate. Levers of penis coiling once round.

♀. 2 antepygidial bristles, of which the lower is distinctly the shorter. Head of spermatheca higher than long. Bursa copulatrix (plus duct) long, its apex curved down, around the bases of the duct of the spermatheca and the blind duct a sclerification. Anal sternite with ventral bristles from near base, outline of under surface not angulate.

Nearctic.——Here also belong : *O. bruneri* Baker 1895, *O. labis* J. & R. 1922, *O. saundersi* Jord. 1933 and *O. tuberculatus* Baker 1904.

7. **Oropsylla** Wagn. & Joff 1926.—Genotype : *O. silantiewi* Wagn. 1898.

♂♀. Group B. Frontal tubercle sharp, more or less sunk into frons. Rostrum reaching beyond trochanter. Basal abdominal sternite without patch

of bristles on side, at most with 1 or 2 in or below middle (besides the usual ventral bristles).

♂. Bristles of segment II of antenna short (not reaching to middle of club). VII. t. not excised medianly between the sets of antepygidial bristles (1 long, 1 minute). VIII. st. narrow, rod-like, without membranous apical appendage, apex sharply defined, with long bristles. Process of clasper broad; exopodite claviform. Apical membranous area of IX. t. about one-third as long as pygidium, not spinulose. Levers of penis with one complete convolution, or a little longer.

♀. 3 or more antepygidial bristles. Stylet with 2 or more lateral bristles. Head of spermatheca longer than broad, ovate or pyriform, tail short, not (or not much) longer than head, always with long appendage. Bursa copulatrix long, apex strongly curved ventrad, without sclerification at origin of the two ducts emanating from it.

Nearctic and Palaearctic.——Here also belong: *O. alaskensis* Baker 1904 (comb 25 or 26 spines!), *O. arctomys* Baker 1904, *O. idahoensis* Baker 1904 (= *poeantis* Roths. 1905 = *bertholfi* Fox 1927), and *rupestris* Jord. 1929. Palaearctic species enumerated in Wagner, *Katalog pal. Aphan.* p. 12, but *mandarinus* belongs to *Diamanus* (*cf.* above).

8. **Amphalius** nov. gen.—Genotype: *A. runatus* Jord. 1923.

♂♀. Group B. Frontal tubercle sharp, more or less sunk into frons. Eye not reduced. Rostrum reaching to apex of trochanter. Bristles of segment II of antenna long. Comb with more than 24 spines. Basal abdominal sternite without lateral bristles. Mid- and hind femora without a sublateral row of bristles on outside (apart from 2 or 3 bristles towards apex); bristles on midtarsal segment II very numerous, most of them slender; first pair of plantar bristles of V in all tarsi somewhat shifted inward and very distinctly bent ventrad-inward. VII. t. slightly projecting medianly in between the two sets of antepygidial bristles.

♂. VII. t. incised below cone of long antepygidial bristle, above the long bristle a minute one. VIII. t. very large, with a few spicules in dorsal area on inside; stigma cavity narrow and very long. VIII. st. narrow, fringed on upperside, before point of division a long bristle, a very large membranous fringed apical flap supported by a rod-like ventral continuation of the main portion of the segment. Vertical arm of IX. st. with tooth above middle of posterior margin. Process of clasper very long and narrow; exopodite with a long ventral process which is dilated at apex. Ejaculatory duct distally enclosed in a very long sheath which is curved frontad, then distad, then again frontad. Pale apical area of IX. t. behind pygidial plate about half the length of that plate, minutely spinulose at posterior margin. Anal sternite somewhat longer than tergite, narrow, with numerous bristles at apex and near it at dorsal margin.

♀. Stylet cylindrical, apex rounded off, bearing numerous bristles. Anal sternite angulate beneath, with bristles in apical half only. 3 antepygidial bristles. Bursa copulatrix (inclusive of its duct) very long, broad, of nearly the same width from base to apex; spermatheca long, without division between head and tail, head less than one-half wider than tail.

Nearctic and Palaearctic.——Here also belong: *O. necopinus* Jord. 1925 (Nearctic) and *O. clarus* J. & R. 1922 (Asiatic).

9. **Foxella** Wagn. 1929.—Genotype: *F. ignotus* Baker 1895.

♂♀. Group B. Frontal tubercle sharp if exposed. Rostrum not reaching trochanter. Eye vestigial. Upper eye-bristle above eye. Hindfemur with complete row of bristles on both sides. Segment V of hindtarsus shorter than III, all plantar bristles lateral.

♂. Bristles of segment II of antenna short. One long and one very short antepygidial bristle. VIII. st. small, without apical membranous lobe, close to apex a long bristle. Process of clasper narrow, conical; exopodite very long, narrow. Apical area of IX. t. behind pygidial plate setiferous at apex. Apices of anal tergite and sternite on a level, tergite conical, sternite not pointed, with many apical bristles (as in *Opisocrostis* and *Oropsylla*).

♀. Bristles of segment II of antenna long. 3 antepygidial bristles. Basal abdominal sternite with lateral bristles. Stylet with 2 or 3 lateral bristles. Anal sternite not distinctly angulate beneath, with bristles from near base. Spermatheca as in *Oropsylla*.

Nearctic.——Only one species, which has split up into a number of subspecies.

10. **Dactylopsylla** Jord. 1929.—Genotype: *D. bluei* Fox 1909.

♂♀. Group B. Like *Foxella*, but first pair of plantar bristles of tarsal segment V more distinctly bent downward-inward. Hindtibia with more than 20 stout dorsal bristles. The small bristles above antennal groove more numerous in ♂. Apical lobe of IX. st. of ♂ not hinged on to the segment, but continuous with it, the segment broadly sinuate ventrally, the sinus bounded by projections bearing bristles. Head of spermatheca longer than in *Foxella*.

Nearctic.——Here also belongs: *D. comis* Jord. 1929.

11. **Ceratophyllus** Curtis 1832.—Genotype: *C. hirundinis* Curtis 1832.

♂♀. Group C. Eye not reduced. Pronotal comb with 24 or more spines. Occiput with 2 lateral median bristles. Proboscis not reaching beyond apex of forecoxa. Bristles of segment II of antenna reaching in ♂ beyond middle of club, in ♀ beyond apex.

♂. 3 antepygidial bristles, 1 long, 2 minute. VIII. t. with spiculose dorsal area (sometimes restricted to margin). VIII. st. rod-like, with apical bristles (often spiniform) and apical flap. Apex of vertical arm of IX. st. widened posteriorly; ventral arm with the antemedian rounded dilatation and the proximal angle of apical lobe setiferous. Anal sternite narrow (lateral aspect), longer than tergite, with the bristles dorsal and apical.

♀. 3 antepygidial bristles, 1 long, 2 much shorter. Bursa copulatrix and spermatheca variable, in typical species the portion of duct of spermatheca nearest bursa copulatrix more strongly chitinised, being a conspicuous tube, and head of spermatheca cylindrical, concave above, several times as long as broad.

Palaearctic and Nearctic.——8 species are known from America: *C. celsus celsus* Jord. 1926 (*C. c. apricus* Jord. 1929 from Cuba), *C. diffinis* Jord. 1925, *C. gallinae* Schrank 1803, *C. garei* Roths. 1902, *C. gilous* J. & R. 1922, *C. idius* J. & R. 1920, *C. niger* Fox 1908, *C. riparius* J. & R. 1920.

12. **Dasypsyllus** Baker 1905.—Genotype: *D. gallinulae* Dale 1878.

♂♀. Group C. Occiput with more than 2 median bristles. Comb with 24 or more spines. Third pair of plantar bristles of tarsal segment V shifted on to ventral surface. One long antepygidial bristle and two minute ones in both sexes, or upper and lower bristles in ♀ at less than half as long as middle one. Eye very large. Frons with 2 or 3 rows of bristles. Bristles of segment II of antenna long. Stylet with one longish lateral bristle.——Thus defined we can place into *Dasypsyllus* also the species from temperate South America. It is not a homogeneous assemblage.

Palaearctic, Oriental, Nearctic and Neotropic.——Here belong, besides the genotype (which occurs in the Palaearctic and Nearctic Regions, 2 subspecies): *D. aemulus* Jord. 1933, *D. araucanus* J. & R. 1920, *D. comatus* Jord. 1933, *D. cteniopus* J. & R. 1920, *D. klossi* Roths. 1919 (Sumatra) and *D. lasius* Roths. 1909. The most aberrant is *D. cteniopus*, which agrees in many details with *M. telchinum*.

13. **Malaraeus** nov. gen.—Genotype: *M. telchinum* Roths. 1905.

♂♀. Group C. Eye distinctly reduced, its longest diameter shorter than the distance from eye to apex of angle of the strongly chitinised portion of the genal lobe. 2 to 4 median bristles on occiput. Bristles of segment II of antenna short in ♂, reaching beyond middle of club or being shorter in ♀.

♂. VIII. t. at most with traces of spiculose area at dorsal margin. VIII. st. quite reduced (*telchinum, eremicus, sinomus*), or long and narrow, bearing a long apical bristle and a fringed membranous flap (*euphorbi, bitterootensis, penicilliger*). Apex of vertical arm of IX. st. rounded on posterior side, not or little dilated.

♀. Stylet without a dorsal lateral bristle. Stout bristles of anal sternite markedly curved. Head of spermatheca broad, more or less barrel-shaped, but concave beneath, widest either near orifice or in middle, much longer than broad, twice as wide as tail.

Nearctic and Palaearctic.——Here belong 5 species besides the genotype, all Nearctic, with the exception of *penicilliger*, which is circumpolar: *M. eremicus* Baker 1904 (remarkably different in the ♂-genitalia), *M. bitterootensis* Dunn & Parker 1923 (= *isus* Jord. 1925), *M. euphorbi* Roths. 1905, *M. penicilliger* Grube 1852 (♂-genitalia very different), and *M. sinomus* Jord. 1925.

14. **Nosopsyllus** nov. gen.—*N. fasciatus* Bosc 1801.

♂♀. Group C. As in *Malaraeus* n.g., but segment I of the hindtarsus a little shorter than II and III together, no bristle of I and II reaching beyond the segment following. Eye not reduced.

♂. Anal tergite narrow, conical, dorsally with bristles to near base, anal sternite not extending beyond tergite, with bristles only at apex and dorsal margin. VIII. st. quite small, within VII. st., without bristles. Vertical arm of IX. st. triangularly dilated on frontal side below apex, which is narrow; in middle of ventral arm a narrow sinus, proximally of sinus a few short bristles, one of which is thicker and longer than the others, apical half of IX. st. broad.

♀. Anal sternite angulate in middle. Bursa copulatrix with long, rather strongly chitinised duct, upper end membranous, rolled up in a spiral. Sperma-

theca with larger head, which is more strongly rounded above than below, at the most one-third longer than broad, tail long and about half as wide as the head.

Old World; besides the genotype another species has reached America: *N. londiniensis* Roths. 1903. The Chilean *N. endymionis* Roths. 1904 is possibly distinct from *N. fasciatus*; only some ♀♀ are known.

15. **Megabothris** nov. gen.—Genotype: *M. walkeri* Roths. 1902.

♂♀. Group C. Stigma-cavity of VIII. t. very large, stigmata of metepimerum and abdominal segment II rather large and appearing doubled up (as in *Ceratophyllus*). Eye not reduced. No bristle of hindtarsal segments I and II reaching beyond the segment following.

♂. Longest bristles of segment II of antenna extending to near or just beyond middle of club. VIII. st. narrow, with 1 or 2 apical bristles (each side) and a membranous flap. Vertical arm of IX. st. widest at apex. Exopodite with conspicuous dark spiniforms.

♀. Bristles of segment II of antenna reaching to near or to apex of club. Stylet with at least 2 lateral bristles. Head of spermatheca much longer and broader than tail, of even width or somewhat narrowed towards tail.

Nearctic and Palaearctic.——Here also belong, of American species: *M. abantis* Roths. 1905, *M. acerbus* Jord. 1925, *M. asio* Baker 1904, *M. atrox* Jord. 1925, *M. groenlandicus* Wahlgr. 1903, *M. immitis* Jord. 1929, *M. lucifer* Roths. 1905, *M. megacolpus* Jord. 1925, *M. quirini* Roths. 1905; of Palaearctic species (besides the genotype): *M. rectangulatus* Wahlgr. 1903 and *M. turbidus* Roths. (= *mustelae* Wagn. nec Dale) (and possibly others not in our collection).

The species here united in one genus present many important differences; but it is convenient to keep them together. *M. atrox* with its comb of more than 25 spines recalls the Bird-fleas (*Ceratophyllus* s.str.).

16. **Pleochaetis** nov. gen.—Genotype: *P. mundus* J. & R. 1922.

♂♀. Group C. Frons with 2 or 3 rows of bristles, on occiput 2 or more behind base of antennal groove and 3 or more in middle. Rostrum not extending beyond apex of forecoxa. Hindtarsus without long bristles; first pair of plantar bristles more or less distinctly bent ventrad-distad.

♂. Bristles of segment II of antenna short. Spiculose dorsal area of VIII. t. barely vestigial, at base of margin. VIII. st. narrow, short or long, with one or more apical bristles and with or without membranous flap. Anal sternite not extending beyond tergite, bristles apical and subapical.

♀. Bristles of segment II of antenna not reaching to apex of club, usually short. 1 long and 2 short antepygidial bristles. (Spermatheca of 2 different types.)

Neotropic northward to Arizona.——Here also belong: *P. apollinaris* J. & R. 1921, *P. campaniger* Jord. 1931, *P. dolens* J. & R. 1914, *P. equatoris* Jord. 1933, *P. graphis* Roths. 1909, *P. sibynes* Jord. 1925.

The species probably represent at least 2 genera. In the ♀♀ of *P. graphis* and *P. campaniger* the stylet has only 1 lateral bristle and the head of the spermatheca is subglobular, whereas in the 5 other species the stylet has 2 lateral bristles and the head of the spermatheca is much narrower and nearly oblong.

17. **Monopsyllus** Kolen. 1857.—Genotype: *M. sciurorum* Schrank 1803.

♂♀. Group C. Eye not reduced, its longest diameter longer than the distance of the eye from the angle of the strongly chitinised portion of the genal lobe. On occiput 2 median bristles, upper small. Comb with 22 or fewer spines. No bristles on hindtarsal segments I and II extending beyond the segment following.

♂. Bristles of segment II of antenna not reaching beyond middle of club. 1 long antepygidial bristle and 2 minute ones. VIII. t. without spiculose dorsal area on inner side. VIII. st. narrow, with or without membranous apical flap. Frontal margin of IX. t. forming with manubrium of clasper an angle much smaller than 90°, the angle rounded off.

♀. Bristles of segment II of antenna reaching to or beyond apex of club. Stylet with 2 lateral bristles. Spermathecae of different types.

This diagnosis permits us to place into *Monopsyllus* some Nearctic species which are not very nearly related to *M. sciurorum*.

Palaearctic and Nearctic.——Here belong 9 species besides the genotype; Palaearctic: *M. indages* Roths. 1908, *M. argus* Roths. 1908 and *anisus* Roths. 1907 (all three near *M. sciurorum*); Nearctic: *M. eumolpi* Roths. 1905, *M. ciliatus* Baker 1904, *M. vison* Baker 1904, and *M. wagneri* Baker 1904, *M. thambus* Jord. 1929 and *M. enderleini* Wagn. 1933 (the last three might be separated generically on account of the peculiar spermatheca, which, however, is not yet known of *M. thambus*).

18. **Mioctenopsylla** Roths. 1922.—Genotype: *M. arctica* Roths. 1922.

♂♀. Group C. Pronotum long, with an additional row of bristles; spines of comb quite short, not longer than the apical spines of the abdominal segments.

Circumpolar.——Only one species known (synonym: *Boreopsyllus hadweni* Ewing 1827).

## KEY TO THE GENERA.

Group A.—Outer surface of forefemur with 1 or no lateral bristle; no thin longish bristles on inside of mid- and hindcoxae from base to apex.

*a*. Segment I of hindtarsus longer than II to IV . . 3. *Tarsopsylla*
,, ,, ,, shorter ,, ,, . . . *b*

*b*. ♂: VIII. st. with apical membranous appendage, F with 4 to 7 short spiniforms directed upwards. ♀: ventral margin of X. st. distinctly angulate near middle . . . . . 1. *Orchopeas*
♂: VIII. st. without apical membranous appendage, F with 2 or 3 spiniforms direct downwards or distad. ♀: ventral margin of X. st. not distinctly angulate . . . 2. *Opisodasys*

Group B.—Outer surface of forefemur with several small lateral bristles; on inside of mid- and hindcoxae longish thin bristles from base to apex.

*c*. Eye vestigial . . . . . *d*
Eye well developed . . . . . *e*

*d*. Hindtibia with fewer than 20 stout dorsal bristles . . 9. *Foxella*
,, ,, more ,, ,, ,, ,, . 10. *Dactylopsylla*

*e.* ♂: ejaculatory duct deeply curved twice, apex directed frontad. ♀: stylet stout, cylindrical, with numerous bristles at apex 8. *Amphalius*

♂: ejaculatory duct normal. ♀: stylet with 1 apical bristle, which is long . . . . . *f*

*f.* ♂: VIII. t. large, not reduced to a narrow horizontal sclerite. ♀: basal abdominal sternite without patch of lateral bristles, head of spermatheca broader than long, stylet with 2 or 3 lateral bristles 4. *Thrassis*

♂: VIII, st. quite small. ♀: dorsal lateral bristle of stylet much smaller than ventral one . . . . . 5. *Diamanus*

♂: VIII. st. narrow, horizontal, with apical bristles and apical membranous flap. ♀: basal abdominal sternite with patch of latera bristles, head of spermatheca broader than long 6. *Opisocrostis*

♂: VIII. st. narrow, horizontal, with apical bristles, but without apical membranous flap. ♀: head of spermatheca longer than broad, ovate or pyriform . . . . . 7. *Oropsylla*

Group C.—Outer surface of forefemur with a number of small lateral bristles; on inner side of mid- and hindcoxae longish thin bristles at most in apical half.

*g.* Spines of comb quite short . . . . . 18. *Mioctenopsylla*

,, ,, normal . . . . . *h*

*h.* Stigma of VIII. t. much enlarged . . . . 15. *Megabothris*

,, ,, normal . . . . . *i*

*i.* In comb 24 or more spines. Eye not reduced . . . *j*

,, fewer than 24 spines . . . . . *k*

*j.* Third pair of plantar bristles of tarsal segment V moved on to ventral surface . . . . . 12. *Dasypsyllus*

Third pair of plantar bristles lateral . . . 11. *Ceratophyllus*

*k.* Occiput with 2 or more longish bristles behind base of antennal groove and 3 or more in middle . . . . 16. *Pleochaetis*

Occiput with 1 or no longish bristle behind base of antennal groove *l.*

*l.* Eye distinctly reduced, its longitudinal diameter shorter than the distance of eye from apex of incrassate portion of genal lobe 13. *Malaraeus*

Eye not reduced . . . . . *m*

*m.* ♂: VIII. st. vestigial, without bristles. ♀: apex of bursa copulatrix rolled up as a spiral . . . . . 14. *Nosopsyllus*

♂: VIII. st. a narrow horizontal selerite with bristles and an apical membranous flap. ♀: apex of bursa copulatrix not rolled up as a spiral . . . . . 17. *Monopsyllus*